Forecasting Tourist Arrivals in Albania Using Time Series Models and Currency Fluctuations

Agresa Qosja[*1, 2], Eralda Gjika [1], Mikaela Bala [1], Lida Filipi [1], and Adelina Paskalaj [1]

[1]Department of Computer Science, University Metropolitan Tirana, Albania
[2]GIPSA-lab, University Grenoble Alpes, CNRS, Grenoble INP-UGA, France

[*]aqosja@umt.edu.al

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Abstract – This study aims to forecast tourist arrivals in Albania by analysing quarterly data from 2016 to the end of 2024, with a particular focus on the role of currency fluctuations, specifically the Euro, which is commonly used in conjunction with the Albanian Lek. While a number of economic indicators were considered, including GDP and other foreign currencies, the only one that showed a substantial correlation with tourist traffic was the Euro. To predict and project tourist flows, time series models were employed, including Exponential Smoothing (ETS), ARIMA, TBATS, and a regression model where the independent variable is Euro and ARIMA-modeled residuals. The forecasting performance of each model was evaluated using standard accuracy metrics: Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and Mean Absolute Percentage Error (MAPE). Results indicate that the ETS model outperformed all others, achieving the lowest error rates. ARIMA and TBATS indicated higher error margins, and the regression-residual hybrid approach performed moderately. These findings highlight the explanatory power of the Euro in mimicking tourist demand in Albania and signal ETS to be the optimal model for short-term forecasting in this regard. The study provides valuable guidelines for tourism planners and policymakers seeking data-driven strategies for anticipating tourist flows.

Keywords – Prediction, Tourist, Time Series, Seasonality, Arima, ETS.

I. INTRODUCTION

   Tourism plays a significant role in Albania's economic development, substantially contributing to national income, employment, and international recognition. In recent years, the country has experienced a consistent rise in tourist arrivals, particularly from European countries, generating growing interest in understanding and forecasting tourism demand. [1, 2] Accurate and timely forecasting supports strategic planning in areas such as infrastructure development, seasonal labor management, and marketing efforts. Given the sensitivity of tourism to external economic conditions, identifying key predictors of tourist flows is essential for developing reliable forecasting models and ensuring preparedness for potential demand fluctuations [3].

Among various macroeconomic indicators, currency exchange rates have been recognized as influential drivers of international travel behavior, affecting both the affordability of destinations and tourists' purchasing power. In the Albanian context, the Euro (EUR) holds particular relevance due to its widespread use within the tourism sector. While several economic factors such as GDP and other currency exchange rates were initially considered in this study, only the Euro exchange rate demonstrated a statistically significant correlation with tourist arrivals.

This paper investigates the forecasting potential of the number of tourists by applying the models: ETS (Exponential Smoothing), ARIMA (Autoregressive Integrated Moving Average), TBATS, and a hybrid regression model, over quarterly time series from 2016 to 2024. These models reflect a broad spectrum of forecasting techniques, from classical statistical approaches to more flexible and adaptive frameworks. The study contributes to the growing body of literature on tourism forecasting in emerging destinations, providing practical insights for policymakers aiming to implement data-informed strategies for managing tourism demand.

Foundational models such as ETS and ARIMA are frequently adopted due to their ease of implementation and strong short-term forecasting capabilities [4, 5]. Although univariate time series models often perform well in stable environments with cyclical patterns, recent research has highlighted their limitations in capturing abrupt economic changes, such as those associated with currency crises or volatile exchange rate movements [6, 7]. As currency fluctuations typically measured through changes in bilateral exchange rates have a direct impact on travel costs, they are broadly acknowledged as critical variables in tourism demand modeling [10, 11, 12]. Different research approaches from various econometric and time series models have been adapted to incorporate exchange rates either as exogenous variables or within composite price indices defined in the currency of the tourist's country of origin or the destination [13, 14].

The remainder of the paper is structured as follows: Section 2 outlines the research methodology used for data analysis and model development. Section 3 presents the results and key findings. Sections 4 and 5 are dedicated to the discussion and conclusion, respectively, focusing on the applied models and the proposed forecasting approach.

II. METHODOLOGY

Forecasting tourist arrivals with time series methods integrated with economic data and currency variables is a representative approach for tourism dependent economies, so policymakers and industry stakeholders are enabled to make better decisions. This is a methodology that leverages the historical patterns that exist in tourist numbers. Prediction accuracy is improved through the incorporation of macroeconomic indicators as well as exchange rates. Variables studied focusing on the tourist prediction horizon in Albania are: historical values of tourist number, currency exchange rates especially EURO which most of the time is used instead of Albanian Lek, and country GDP. These data are selected from 2016 to 2024. Models are trained and tested over the same scenarios on existing data. It also created a future prediction schema for the next 3 years 2025 to 2027. All the data are considered into a quarterly periodicity since it considers the tourist seasonality and the yearly natural seasons during the different climate conditions in Albania as a Mediterranean location. The tourist data used in the models is a sum of all the tourists coming from three main routes in the country from sea, air, and land. The Institute of Statistics measures the data for tourist categories as well as GDP rates [8] and the Bank of Albania provides the public exchange rates data [9].

A. Models

The forecasting models for predicting the number of tourists visiting the country during the years are based over the real data and their features. These models include classical time series approaches such as Exponential Smoothing (ETS) and the Autoregressive Integrated Moving Average (ARIMA) model, as

well as more advanced techniques like the TBATS model (which incorporates Trigonometric seasonality, Box-Cox transformation, ARMA errors, Trend, and Seasonal components) [7]. Additionally, a hybrid regression model is introduced, where the number of tourists is predicted using the exchange rate between the Euro and the Albanian Lek as an external explanatory variable, while the residuals are further refined using an ARIMA model.

These models are chosen based on their suitability for capturing specific characteristics observed in the dataset, such as trend, seasonality, and autocorrelation. The TBATS model is effective in handling complex seasonal patterns and nonlinear transformations, while ARIMA is based on strong autocorrelation and non stationary behavior. The hybrid regression model allows for the integration of external economic indicators, adding an explanatory dimension to the forecasting process. This modeling approach ensures that the prediction framework aligns closely with the underlying structure of the real world data, ultimately improving the accuracy and reliability of the tourist arrival forecasts.

B. Dataset

The data used in this study are obtained from official public sources [8, 9], which report on tourism trends and related policy measures on the economic side. The forecasting models are developed using quarterly data covering the period from 2016 to 2024. The dataset is divided into training and testing sets using the same proportions for all the models. Specifically, data from 2016 to 2022 are used for training, while the data from two years, 2023 and 2024, are used for testing. The target variable is the total number of tourists per quarter.

Figure 1 presents the total number of tourists, as a sum of their mode of entry into the country, by land, air, or sea. The results indicate that land travel accounts for the majority of tourist arrivals, while air and sea entries represent smaller proportions. The impact of the COVID-19 pandemic on this sector is evident from the first quarter of 2020 through the end of the second quarter of 2021. During this period, the typical annual seasonality observed in previous years was disrupted, exhibiting notable deviations in both pattern and total number of tourists.
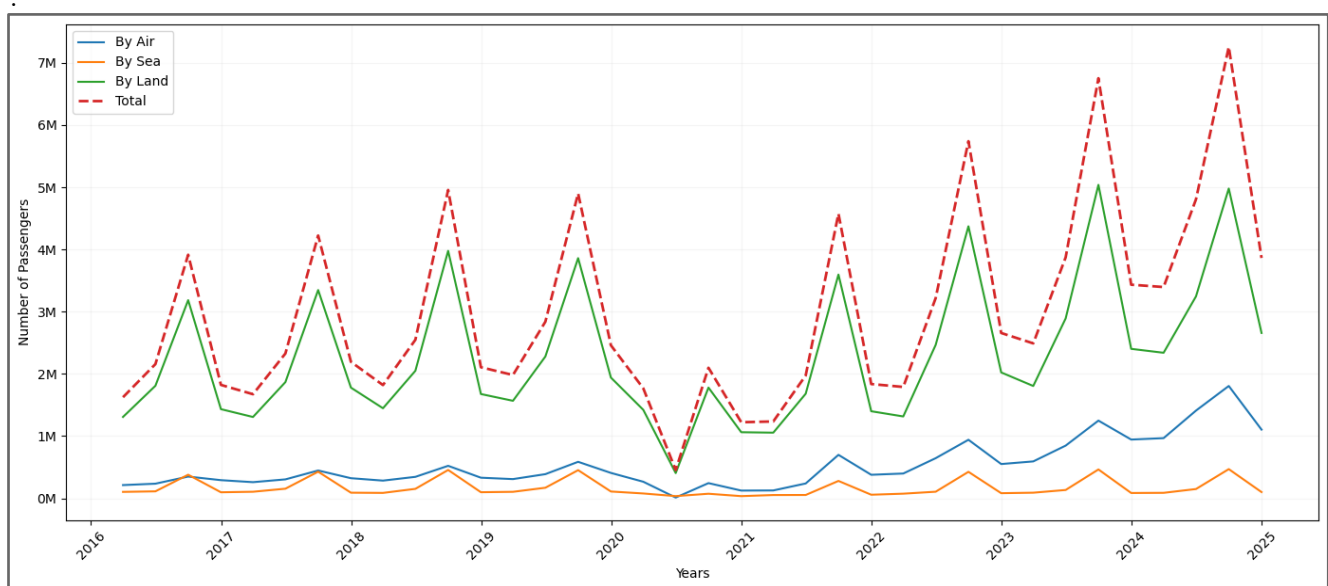

Fig. 1 Number of tourists based on the way of arrival in Albania (Source: Authors)

Considering Fig.1 from another perspective we have presented in the table below (Table 1) a summary of the percentage distribution of tourists entering the country by the mode of transport, air, sea, and land, from

2016 to 2024. The data reveals notable trends in the preferred modes of arrival over the period of study. The proportion of tourists arriving by air shows a steady increase, rising from 11.46% in 2016 to 27.37% in 2024. This suggests an increasing reliance on air travel, possibly due to improvements in air connectivity, increased flight availability, or shifts in tourist preferences. The share of tourists arriving by sea remains relatively low and stable, fluctuating between 4% and 7.5% throughout the years. This implies that sea transport has a minor but consistent role in tourist arrivals. The majority of tourists consistently arrive by land, although this share gradually decreases from 81.25% in 2016 to 68.44% in 2024. Despite the decline, land travel remains the dominant mode, reflecting geographic, economic, or infrastructural factors favoring land border crossings. These trends may reflect broader changes in transportation infrastructure, tourism policies, and international mobility patterns impacting the country over this timeframe.

Table 1. Percentage Distribution of Tourist Arrivals by Mode of Transport (2016–2024)

Year	By Air (%)	By Sea (%)	By Land (%)
2016	11.46	7.29	81.25
2017	12.82	7.49	79.69
2018	12.99	6.95	80.06
2019	13.91	6.88	79.21
2020	11.71	4.04	84.25
2021	15.00	4.63	80.37
2022	18.92	5.15	75.92
2023	21.97	4.69	73.35
2024	27.37	4.19	68.44

Starting from 2016 the exchange rate of EURO to Albanian Lek has been decreasing over time from 1 EURO to 140 Albanian Lek to 1 Euro to less than 100 Albanian Lek. Considering the correlation between the total number of tourists and the exchange rate between Euro and Albanian Lek, we have found a negative correlation in all the years of study. This suggests that as the value of the Euro depreciates relative to the Lek, the number of incoming tourists tends to increase, potentially indicating that a stronger Lek enhances Albania's attractiveness as a travel destination by reducing costs for Eurozone visitors.
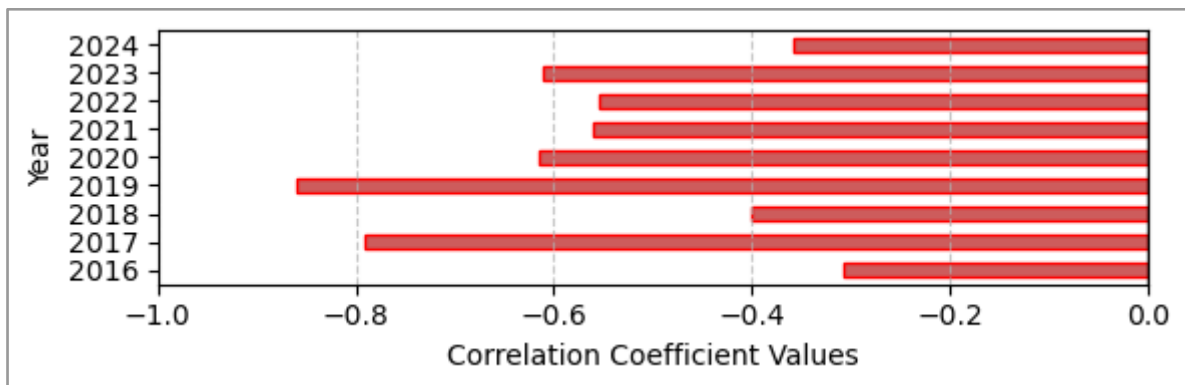

Fig. 2 Number of tourists based on the way of arrival in Albania (Source: Authors)

III.   RESULTS

The models were evaluated based on their performance over the full years of 2023 and 2024. Both ARIMA and the Regression model generally captured the underlying patterns of the data across all quarters. However, in terms of accuracy, the predictions generated by the Regression model were closer to the actual observed values. A confidence interval was applied, indicating a potential deviation in predictions within a range of ±5%.
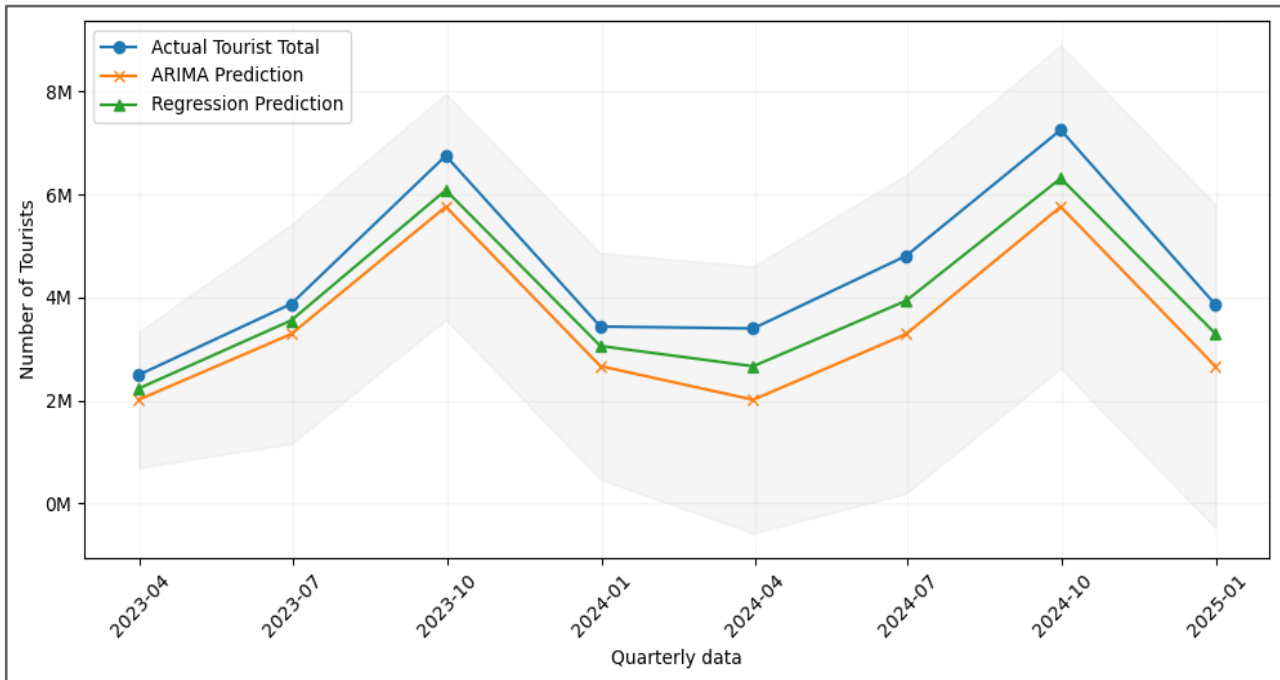

Fig. 3 Results form the models over the testing part of the data (Source: Authors)

The projection over the next 3 years of the number of tourists is realized by ARIMA, ETS, TBATS and the Regression model adding also the confidence interval within a range of ±5%. The trend of total number of tourists is increasing over the next 3 years.

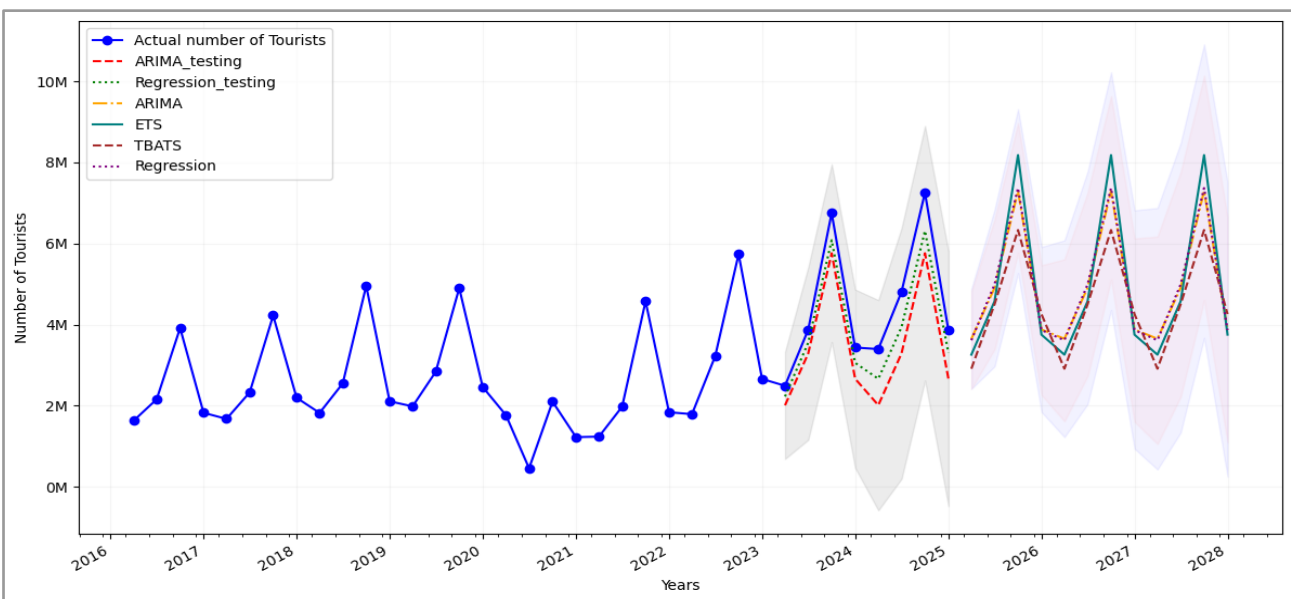Fig. 4 Results form the models over the next 3 years. (Source: Authors)

Measurement of the models based on the real data of total number of tourists T_r^i on the quarter i and the predicted results from the corresponding models T_p^i.

- Mean Absolute Error: MAE $= \frac{1}{n} \sum_{i=1}^{n} \ \ |T_r^i - T_P^i|$

- Root Mean Squared Error: RMSE $= \sqrt{\frac{1}{n} \sum_{i=1}^{n} \ \ (T_r^i - T_P^i)^2}$

- Mean Absolute Percentage Error: MAPE $= \frac{100\%}{n} \sum_{i=1}^{n} \ \left| \frac{T_r^i - T_p^i}{T_r^i} \right|$

The results from the measurement are represented in the following figure (Fig 4) where the ETS model has the highest performance over the dataset. While the other models have
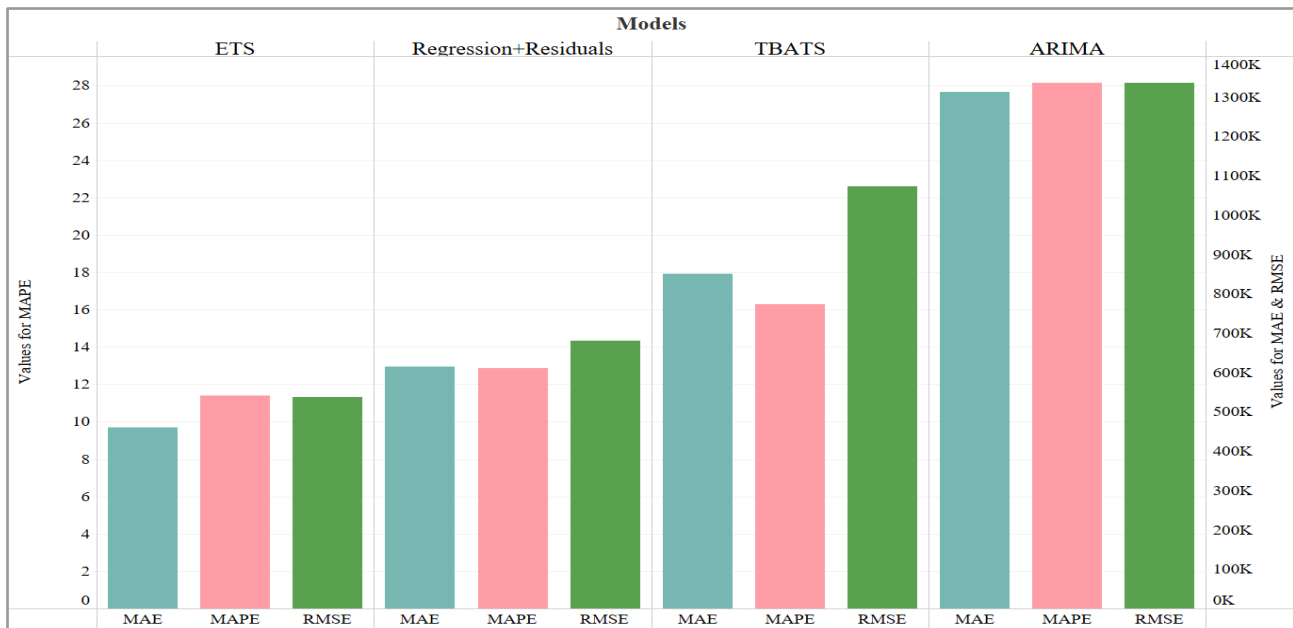

Fig. 4 Results form the models over the testing part of the data (Source: Authors)

IV.   DISCUSSION

The results of this study highlight the significant role that the Euro exchange rate plays in influencing tourist arrivals in Albania and otherwise. Among the models tested, the ETS model showed superior forecasting accuracy, suggesting its effectiveness in capturing the underlying seasonal and trend components of the tourist data. Although ARIMA and TBATS models are well-known for handling complex time series data, their performance was somewhat less precise in this context, likely due to the irregularities caused by external effects such as the COVID-19 pandemic.

The hybrid regression model integrating the Euro as an explanatory variable demonstrated moderate success, confirming the importance of currency fluctuations in shaping tourism demand. However, the complexity added by the residual ARIMA component did not substantially improve accuracy beyond ETS alone. This suggests that while economic indicators like exchange rates are relevant, the intrinsic patterns in tourist arrivals, such as seasonality and trend, remain dominant drivers that ETS captures efficiently. The increasing trend in tourist arrivals predicted for the coming years aligns with Albania's growing appeal as a Mediterranean destination and improved transport infrastructure, particularly air travel. This insight

provides valuable guidance for policymakers and tourism planners to optimize resource allocation and marketing efforts in anticipation of rising tourist demand.

V. CONCLUSION

This study has demonstrated the efficacy of time series forecasting models in predicting tourist arrivals in Albania, with a focus on the influence of currency fluctuations, particularly the Euro exchange rate. The ETS model emerged as the most accurate and robust forecasting method among those tested, effectively capturing the seasonal and trend patterns inherent in the quarterly tourist arrival data. While the Euro exchange rate showed a significant correlation with tourism demand and was integrated into a hybrid regression model, univariate time series models such as ETS still outperformed the hybrid approach. This underlines the importance of intrinsic temporal patterns in tourism data and suggests that currency effects, although relevant, should complement rather than replace traditional time series modeling. The projected growth in tourist arrivals over the next three years signals positive prospects for Albania's tourism sector. This research contributes valuable insights and practical tools for data-driven tourism management in emerging destinations like Albania, facilitating improved anticipation of tourist flows amid evolving economic conditions.

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